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Social Sciences and Humanities
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Canada

THIRD DAY.—SUNDAY, 29th May.

In connection with the Conference PROFESSOR W. P. PATERSON, D.D. (Edinburgh University), preached a Sermon on "Reverence," in ST. GEORGE'S CHURCH (United Free), Shandwick Place, at 11 o'clock.

The DEAN OF ST. MARY'S CATHEDRAL kindly arranged that the Evening Service should have special reference to the Conference.

FOURTH DAY.—MONDAY, 30th May.

Forenoon, 10.30. MRS. FRANKLIN in the Chair.

"**Relation of Home and School.**" Paper contributed by DR. BURGE, Head Master of Winchester School.

"**Parents and Lessons.**" MRS. CLEMENT PARSONS, London.

"**Mathematical Teaching and its place in General Education.**" T. J. GARSTANG, M.A., Science Master at Bedales School.

Afternoon, 2.30. MRS. HOWARD GLOVER in the Chair.

"**Some Thoughts on Reading with our Children.**" DR. ALEXANDER WHYTE.

"**Field Excursions in Relation to Nature Study.**" DR. R. STEWART MACDOUGALL, M.A., Heriot Watt College.

"**The Educational Value of the Habit of Observing Nature.**" REV. CANON RAWNSLEY.

4.30. At Falcon Hall, Morningside, MRS. J. G. BARTHOLOMEW **At Home** to Members of the Conference.

Evening, 8. LADY CAMPBELL in the Chair.

"**The Place of Music in Education.**" PROFESSOR NIECKS, MUS.D., Edinburgh University.

An Ambleside Evening. A Paper on "Scottish Ballads" (with illustrations). By a former Student at the House of Education, Ambleside.

FIFTH DAY.—TUESDAY, 31st MAY.

Forenoon, 10.30. REV. HUGH BLACK in the Chair.

"**Training in the Service of Man.**" J. LEWIS PATON, M.A., Head Master of Manchester Grammar School.

"**The Modern Girl's Demand for Work.**" MISS BANNATYNE, Glasgow.

Afternoon, 2.30 Meeting in co-operation with the Scottish Mothers' Union.

"**A Vital Education.**" MRS. CLEMENT PARSONS, London.

"**Some Good Gifts for Children.**" REV. DR. HUNTER, London.

4.30. Tea in the Arch Halls, by invitation of the Committees of the Edinburgh Conference and the Scottish Mothers' Union.

Most of the papers will appear in the July and August "Reviews," and as far as possible in the above order.

NATURE AND NURTURE.

BY PROFESSOR J. ARTHUR THOMSON,

University of Aberdeen.

"NATURE AND NURTURE" is the title of my short paper, and I hope it has suggested that I mean to say a little about some aspects of those problems which are summed up in the rather ugly word "heredity." I hope so, because many people have as much repugnance to talk about heredity as to talk about predestination.

This repugnance is based on the mistaken impression that what is called "the doctrine of heredity" is not practically suggestive. The study of heredity, we are told, brings us face to face with the predetermined and the inevitable; it suggests that the issues of life are decided by the irrevocable past rather than by the plastic present; it tends, in a word, to Fatalism. The child cannot choose its parents; we cannot prune our genealogical tree; the Fates of the South and the Norns of the North are with us still at every birth, though their names have been changed; why then talk about what is already so settled, when we all wish to *do* something? A discourse on "The Chances of Life" would not be very appropriate in a hospital for incurables!

But this is a narrow and cowardly repugnance. We cannot seriously propose to imitate the ostriches of literature who stick their heads into the sand. In our better moods we are all prepared to face up to the facts of life and to be rid of make-believe. We must therefore satisfy ourselves that current statements of the facts of heredity, whether in novel or in sermon, in drama or in biological essay, are *adequate*. It may be that the scientific doctrine of heredity, impregnable as regards its factual basis, is not always stated with due regard to perspective. Perhaps its practical interest for the parent does *not* end when the child begins to live. Perhaps the apparently demoralising fatalism to which it seems to force us is a fallacious inference.

What the Experts say.

If we pause to ask what the experts on heredity have to say, we find that many of their most cherished conclusions require no small degree of preliminary education before they become intelligible.

They tell us that heredity is the relation of genetic continuity between successive generations; that this relation of continuity is sustained in a very remarkable way by a visible material basis, which has a complex architectural organisation, and appears to owe its virtue of reproducing like from like mainly to the fact that it is materially continuous with the germinal substance from which the parent arose. In a sense the child is as old as the parent. There is a continuous chain of germ-cells, and the individual bodies are as it were pendents from this chain, falling off periodically. The parent is rather the trustee of the immortal germ-plasm than the producer of the child. In other words, generations are strikingly continuous, like the plants which arise from the long runners of a strawberry. *There is an unsuspected continuity and solidarity in the succession of generations.*

The experts assure us that the material basis of inheritance—visible, stainable, countable, and so forth—is the bearer not only of general resemblances, so that like always tends to beget like, but also of the minutest peculiarities which were innate in the parents. The abnormal is, for a time at least, as transmissible as the normal, the prejudicial as much as the favourable, though there are at various stages sieves, so to speak, in which the heritable qualities are sifted out. We are offered statistical evidence that mental characteristics are transmissible according to the same laws or modes as are exhibited by physical characteristics.

We are told that in a completed heritage, which means the beginning of a new life, there are always *equal contributions* from the two parents, though it does not follow that both sets of contributions will find *equal expression* in development. But each parent's contribution is in a sense a mosaic of contributions from remoter ancestors.

We learn that while the whole of an inheritance is not usually expressed in an individual development, a number of alternatives of expectation are familiar,—such as general

blending, or preponderance in the line of one parent, or preponderance of one parent as regards one set of characters, and of the other as regards another set. Resemblance to a grandfather is common, and reversion to a remoter ancestor may occur.

We are told that while the stature of the firstborn son of A. and B. cannot be predicted, yet the average stature of the sons of a hundred A.'s and B.'s can be predicted within a fraction of an inch. And even such subtle qualities as longevity and fertility have been proved to be heritable.

We learn that there is a continual tendency in the children of parents in any way extraordinary for good or ill, to approximate to the average of the stock to which they belong—a thesis which Galton has substantiated in his law of Filial Regression.

So many factors combine to make an inheritance, and to admit of this inheritance expressing itself, that prediction in individual cases is always gratuitous, but for large numbers of similar cases the results are usually so orderly that they may be plotted out on a regular curve, and chance becomes transformed into law.

All this and much besides will be found more or less effectively substantiated in the important modern contributions to the study of heredity; and the general result suggests that parents and their offspring—we and ours—are in the grip of a system of things, regular and inexorable in its process. All of which tends to foster the feeling of *fatalism.*

Fallacies of Fatalism.

I think I may possibly do a useful half hour's work if I confine myself to one point and try to show in my own way why the results of the study of heredity do not shut us up to fatalism.

I. Let me begin by referring to what I venture to call *the first fallacy of the fatalists—the fallacy of forgetting abstractions.* For the purposes of scientific analysis we make abstractions, and we are a little apt to use our conclusions without remembering our abstractions. For purposes of dissection or chemical analysis we zoologists abstract our animal subject from its life, but we do not use our conclusions to their full value unless we eventually remember that the dry bones once lived and were a living part of a living whole with definite habits in a particular place.

So in studying heredity, we abstract one particular aspect, namely, the relation of the creature to its parents and progeny, and we are sometimes apt to forget that our formulae of inheritance have to be recombined with what we know of growth and adolescence, of habits and surroundings.

We hear people speak of pitting the influences of environment against those of heredity, of a man fighting against his heredity, of habits confirming inheritance, and so on. Indeed an American writer asks: "Is my heredity my grandfather's environment?" The meaning may be evident enough in each case, but the phraseology does not tend to clear thinking, and it implies the fallacy of forgetting abstractions previously made.

When we think over it quietly, we see that heredity is just a convenient term for the truly wonderful and intricate *relation of genetic continuity which binds generation to generation. An inheritance is all that a living creature is or has to start with in virtue of that hereditary relation.* Therefore when a new life first begins, it is identical with its inheritance, and we can draw no biological distinction between the heir and his legacy. But the characteristics embodied in the inheritance are all *potentialities*, they demand a certain scheme of surroundings, of appropriate liberating stimuli, an environment, between which and the creature there is ceaseless action and reaction. Apart from this environment the potentialities of the germ have no meaning, they cannot express themselves, they require nurture in the widest sense, and they have a normal nurture apart from which they cannot develop rightly. Thus an appropriate environment is, so to speak, the necessary *external heritage* of the germ, and is just as essential as its organically inherited nature. As development proceeds, the germ, which was always a unity, becomes gradually a higher unity—a sentient organism, a higher unity—an infant, a still higher unity—a child, and so on till it is a man or a woman. But all the time, the expression of its hereditary potentialities has depended on a widening environment normal to the species. The hereditary nature cannot find expression except within certain limits of nurture, and these limits of nurture are in our keeping.

II. *The second fallacy of the fatalists is that of particularising average statistical conclusions.* According to Galton's Law of Ancestral Inheritance, each parent contributes on an average a quarter of the hereditary organisation, that is to say, half of the half which each parent *actually* contributes is made up of fractions from grandparents, great-grandparents, and so on. Each parent, as we can corroborate microscopically, contributes a half of the total complement of inheritance-bearers which combine in an intimate and orderly way at the beginning of each new life; but other facts show that each parental contribution is a mosaic, and that not more than half of it can be called distinctively parental. Thus if the total heritage be called 1, it is made up of $\frac{1}{2}$ from the two parents + $\frac{1}{4}$ from the four grandparents + $\frac{1}{8}$ from the eight great-grandparents, and so on. Now, there is a great deal of evidence in support of this general statistical conclusion, which we speak of, for shortness, as Galton's Law. But it must be noticed that it deals only with average contributions. If one of the grandparents of a child was phthisical and another a crank, it by no means follows that one-eighth of the child's inheritance must be affected in these directions. If the law be correct, such ancestral taints will reappear in definite average proportion in a stock unless there is in operation some form of selection, such as might be induced by a prejudice against marrying into markedly phthisical or cranky families. But to suppose that any average statistical conclusion must be verified in an individual case, is happily a fallacy. The tubercular parent does not necessarily have a tubercular child. *Suppose* the mortality from scarlet-fever in children is 20 per cent., and that all the five children of a family were infected, the physician would not be justified in telling the head of the house that one of the five would surely die. Moreover, even when the phthisical or cranky taint is duly inherited, it would of course become the effort of those concerned to try by modified nurture to hinder its expression. What we now know about the phthisical tendency shows that this counteracting of nature by nurture can be most successfully pursued.

And just as in the case of a phthisical predisposition much depends on an early modification of nurture—say fresh-air treatment—so we may generalise and say that, even if no particular taint is known, the importance of *early* control of nurture in the widest sense cannot be readily over-estimated. Male parents in particular are prone to postpone far too long the special form of nurture they believe in; my own experience is that one cannot begin too early and that the first three years of intellectual development—which means expression of inheritance—are just as important as, perhaps more important than, the next three or the next three.

III. *The third fallacy of the fatalists is forgetting variability.* When a new life begins, there is an intimate and orderly union of two sets of hereditary contributions, but these are little worlds in themselves, and no one can tell *a priori* what the result of the permutations and combinations will be. Moreover, each of the two sets of hereditary contributions which unite to start a life has already passed through an intricate sieving process. Moreover, when the two mosaics of inheritance come to close quarters, there is reason to believe that there is an intra-germinal struggle for existence or for expression among the many items of the two mosaics. All this has of course its more technical and precise statement, which would not be intelligible to those who have not followed recent studies in inheritance. But one result is certain, that the offspring may be more or less different from its parents, and even from the average of its stock. The new life is indeed new; it may be—often is—a fresh crystallisation of vital qualities; it may be—often is—a new position of organic equilibrium; it may be—sometimes is—a new architectural style, which means genius.

When a parent is blessed with what we may call a healthy child, he or she cannot of course tell at all what kind of child it will be. But it seems time that it was generally recognised that the child is not likely to be in any way *fortuitous*. It will have maternal characters, paternal characters, grand-parental characters, and ancestral characters, and it may be *novel* characters. In regard to some living creatures, such as peas or mice, it is possible to prophesy in regard to a large number of offspring and for several generations that so many

will be markedly maternal in regard to a given character, that so many will be markedly paternal in regard to a given character, and so on. In regard to a set of 1000 fathers of similar stock, it is possible to predict with great accuracy what the average height of their mature sons will be, and so on. All such data, which will certainly accumulate in the next quarter of a century, will lead the parent to regard his infant, not as a haphazard draw out of a lucky-bag, but as an item in a series of events which can be summed up in a law or in a number of laws.

Although, as I have said, it is a mere abstraction to separate the living creature from its inheritance or from its normal environment, yet we may for a moment picture the young organism as a Mowgli with a burden of twigs upon his shoulders. They are his legacy from the forest in which is his ancestry. they are of all shapes and sizes, some long, some short, some thick, some thin, some green, and others brown. As the Mowgli struggles on through the wood, his bundle takes more definite shape, partly as the stems and branches strike it, partly as weak ends drop off, partly as he adjusts it to his shoulders,—and there is, moreover,an intricate inter-adjustment among the individual sticks, which we call intra-germinal selection. When the bundle of twigs in the course of months or years takes very definite shape, we begin to speak of fixed character in the organism. It is now *a new "it,"* a product of interaction between nature and nurture. But while this new "it" may be predominantly paternal, or maternal, or grand-parental, and so on, there is always the possibility that it may be new in a higher sense, that the bundle may assume a novel pattern, a fresh poise, a new position of equilibrium altogether, and this means in human life *a new variation* which should be carefully looked after, for it is part of the raw material of progress. Here there are two practical suggestions, that we must not expect our children to be replicas of ourselves—the mould is always being broken—but we must look for recrudescences and rehabilitations of ancestral characters, and deal with these as wisely as may be, always bearing in mind that it depends on nurture how much of nature is allowed to find expression, never imagining that a repressed item in inheritance is necessarily extinguished like a snuffed-out candle, never fancying that it need be more than damped down, never believing that it may not assert itself sometime either in our child or in our child's children. And the other practical corollary is, that every apparently new bud on the plus side is something to be nurtured.

It may be objected that the organism is, so to speak, "set" long before birth, that no degree of carefulness in nurture can evoke a quality unless the rudiment is already part of the heritage. If the sense of humour or the æsthetic sense is absent in the hereditary nature, it cannot be developed by nurture. We cannot make bricks without straw, so to speak, or a silk purse out of a sow's ear.

To this, however, it must be answered that it is very rash to assume that a character or sense which does not show itself early is really absent. It may simply have an unusually long latent period, as we know in the case of perfectly normal people who were unusually long in learning to speak, but afterwards spoke much.

For one character that is really absent there are probably several which, though present, are never expressed for lack of the appropriate nurture.

And again, I would remind you of my metaphor of the bundle of sticks in order to suggest that character as a whole depends in great part on *proportion*, and that while we cannot by nurture make up for a quality primordially absent, we can by nurture adjust the balance of moods and qualities, of talents and dispositions.

All this goes to show that nurture should be as all-round as possible, as varied as possible, as free as possible from any undue restraint of parental precedent. The developing inheritance is like a great cluster of heterogeneous buds, some requiring the hot-house, and some the open air.

IV. *The fourth fallacy of the fatalists is forgetting the plasticity of the organism.* If a germ is to develop *at all* there must be a certain minimum of environment—what we call the essential conditions of life, including a certain quantity and quality of food, a certain amount of fresh air and water, a certain range of temperature, and so forth. If an organism is to develop *normally* it must have its appropriate environment, for which, indeed, it has undergone age-long adaptation.

Normal nature must have normal nurture. But apart from these two considerations, there is the well-known fact that changes in nurture within limits may induce changes in the structure and habits of the living creature. We call these changes *modifications* to distinguish them from the deeply-rooted *variations* which have a germinal origin. By "modifications" we mean organic changes due to changes in nurture, which transcend the limits of organic elasticity and persist after the inducing causes have ceased to operate. A man may be tanned by the sun for life, he may develop callosities which never disappear, but these changes are quite different from the inborn peculiarities of his finger-prints which distinguish him even from his brother. We do not know that any of these acquired characters are transmissible, but we know that they can be hammered on successive crops of individuals so that it almost seems *as if* they were inherited. As the degree of modifiability is very great, we are again saved from fatalism.

The slow, sure way of nature is to favour the best stocks, so that they increase in numbers and progress in excellence, and to handicap or prejudice the multiplication of badly tainted or less fit stocks, so that they may eventually wane away—"hampered all by their own death-bringing shackles," as Lucretius phrased it. But, whether this slow and sure method goes on or does not go on in the right direction in human life, we have to use all our endeavours to secure *temporarily and quickly* by changed nurture what changed nature may bring about *slowly and permanently*. If we believe, as I think we must, that the direct structural results of changed nurture are not entailed, there is all the more reason for strenuously trying to secure that they are acquired afresh by each new generation. For this reason, everyone is keen about good education.

It might be objected that we are not agreed as to what the good qualities are. One family would favour artistic nurture, another scientific nurture, another religious nurture—not that these are in any way incompatible. But of course the whole point is that what we favour be at any rate in some sense on the plus side, towards the up-grade of evolution, and not towards degeneration. The more diversity, the more individuality there results, so much the better. And as Galton says, "all except 'cranks' would agree to favour or select such qualities as health, energy, ability, manliness, and courteous disposition." It will be time enough for minuter preferences many generations hence. At present there seems little likelihood of our forgetting the possible racial value of invalid or even morbid types.

V. *The fifth fallacy of the fatalists lies in forgetting that, as far as man is concerned, the external social heritage counts for as much as the organic natural inheritance which is embodied in a physical basis.* Man is a slowly varying, slowly multiplying organism, and it seems a plain fact of history that his progress, such as it is, from century to century, is not so much bred in the bone as constrained by social influences. Unlike the beasts that perish, man has language and literature, permanent products which often sum up the achievements of centuries, an external registration of intellectual and moral conquests—in short, a great system outside himself, yet apart from which he cannot be himself, his *social heritage.* This, of itself, is enough to give us pause in applying too hastily to man, generalisations as to heredity which have been based on peas or pansies, mice or basset hounds.

Thus my general conclusion is this, that, while lasting organic progress, affecting the fundamental heritable constitution of a race or stock, can only be attained by slow changes in the germinal foundations, helped by some of the many forms of selection, yet real progress for the individual directly and for the race indirectly can be attained by improvements in nurture which are entirely within our hands. Of course, in a way, you all knew this very well before, but I have tried to suggest that the vagueness of our parental instincts has now to be corrected and corroborated by the recent results of precise studies in Heredity.

Practical Summary.

To sum up more practically :—

Hereditary nature embodied in a material basis is fundamentally important. There is an inexorableness in the transmission of all sorts of innate characters both for better and for worse. But as the hereditary nature—which can only be changed slowly and with difficulty—depends for its expression or inhibition on the influence of appropriate nurture, we have in our ready control over nurture a means of affecting the results *as far as individuals are concerned.* By modifying nurture we can avoid the fatalism suggested by the laws of natural inheritance.

On the other hand, we must avoid a fatalism of nurture, for the heritable nature is often strong enough to assert itself afresh, when an evil nurture is replaced by something better, or when a good nurture is replaced by something worse.

If we think of a child's inheritance as like a complex inflorescence of heterogeneous buds, some of which open before it is born, while others remain long asleep awaiting the appropriate sunshine of nurture, we must, I think, agree that control of nurture should begin *very* early, that nurture should be wide and varied, that it should be altered from time to time to give some dormant buds a chance, and that it should not be too like that of the parents, nor too conventional if we wish to foster individuality. As we all know, a very difficult problem arises when the home-nurture—controlled more or less by what is understood of the inherited nature—has to be replaced by school and wider nurture. And our thoughts must go forward to the time when, ever so gradually and gently, the growing boy or girl has to become aware of himself or herself as a mosaic of many ancestral contributions, which it is often hard to unify into a stable character. And this finally I venture to emphasize, that in regard to apparent new buds—which we do not quite understand, but which do not seem to be in any way evil—we should try to give them a chance, and in any case we should not rashly repress them. *They may become the finest flowers we ever saw.*